CLAIMS

1. An empty capsid of the infectious bursal disease virus (IBDV), VLP(-VP4), characterized in that it is constituted by assembly of only IBDV pVP2 proteins and IBDV VP3 proteins.

2. A nucleic acid characterized in that its nucleotide sequence is constituted by (i) a nucleotide sequence comprising the open reading frame corresponding to the IBDV pVP2 protein and (ii) a nucleotide sequence comprising the open reading frame corresponding to the IBDV VP3 protein.

3. A gene construct comprising a nucleic acid according to claim 2.

4. An expression system selected from:

a) an expression system comprising (i) a gene construct comprising the open reading frame corresponding to the IBDV pVP2 protein, operatively bound to transcription, and optionally translation, control elements, and (ii) a gene construct comprising the open reading frame corresponding to the IBDV VP3 protein, operatively bound to transcription, and optionally translation, control elements; and

b) an expression system comprising a gene construct according to claim 3, operatively bound to transcription, and optionally translation, control elements.

5. An expression system according to claim 4, said expression system being selected from plasmids, bacmids, yeast artificial chromosomes (YACs), bacteria artificial chromosomes (BACs), bacteriophage P1-based artificial chromosomes (PACs), cosmids, and viruses, which, optionally, contain a heterologous replication origin.

6. A host cell containing a nucleic acid according to claim 2, or a gene construct according to claim 3, or an expression system according to anyone of claims 4 or 5.

7. A host cell that is transformed, transfected or infected with an expression system according to anyone of claims 4 or 5.

8. Host cell according to anyone of claims 6 or 7, said cell being an insect cell or a yeast.

9. A process for the production of empty capsids of the infectious bursal disease virus (IBDV), VLPs(-VP4), according to claim 1, comprising culturing a host cell according to anyone of claims 6 to 8, and if so desired, recovering said empty IBDV capsids.

10. Process according to claim 9, wherein said host cell is an insect cell, comprising the steps of:

a) preparing an expression system selected from:

- an expression system constituted by a recombinant baculovirus containing a gene construct according to claim 3, operatively bound to transcription, and optionally translation, control elements; and

- an expression system constituted by (i) a recombinant baculovirus containing a gene construct comprising the open reading frame corresponding to the IBDV pVP2 protein, and (ii) a recombinant baculovirus containing a gene construct comprising the open reading frame corresponding to the IBDV VP3 protein;

b) infecting insect cells with said expression system prepared in step a);

c) culturing the infected insect cells obtained in step b) under conditions allowing the expression of recombinant proteins and their assembly for forming empty IBDV capsids, VLPs(-VP4); and

d) if so desired, isolating and optionally purifying said IBDV empty capsids, VLPs(-VP4).

11. Process according to claim 9, wherein said host cell is a yeast, comprising the steps of:

a) preparing an expression system constituted by a plasmid containing a gene construct according to claim 3;

b) transforming yeast cells with said expression system prepared in step a);

c) culturing the transformed yeasts obtained in step b) under conditions allowing the expression of recombinant proteins and their assembly to form empty IBDV capsids, VLPs(-VP4); and

d) if so desired, isolating and optionally purifying the empty IBDV capsids, VLPs(-VP4).

12. The use of a gene expression system according to anyone of claims 4 or 5 for producing and obtaining empty IBDV capsids, VLPs(-VP4), according to claim 1.

13. The use of empty capsids of the infectious bursal disease virus (IBDV), VLPs(-VP4), according to claim 1 in the manufacture of a medicament.

14. Use according to claim 13, wherein said medicament is a vaccine against the avian disease called infectious bursal disease.

15. Use according to claim 13, wherein said medicament is a gene therapy vector.

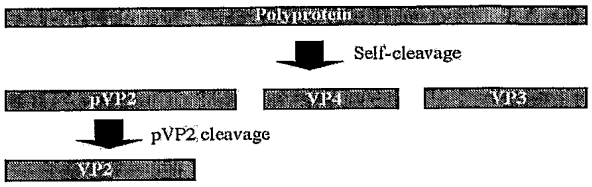
16. A vaccine comprising a therapeutically effective amount of empty IBDV capsids, VLPs(-VP4), according to claim 1, optionally together with one or more pharmaceutically acceptable adjuvants and/or vehicles.

17. Vaccine according to claim 16 to protect birds from the infection caused by the infectious bursal disease virus (IBDV).

18. Vaccine according to claim 17, wherein said birds are selected from the group formed by chickens, turkeys, geese, ganders, pheasants, quails and ostriches.

19. Vaccine to protect chickens from the infection caused by the infectious bursal disease virus (IBDV) comprising a therapeutically effective amount of empty IBDV capsids, VLPs(-VP4), according to claim 1, optionally together with one or more pharmaceutically acceptable adjuvants and/or vehicles.

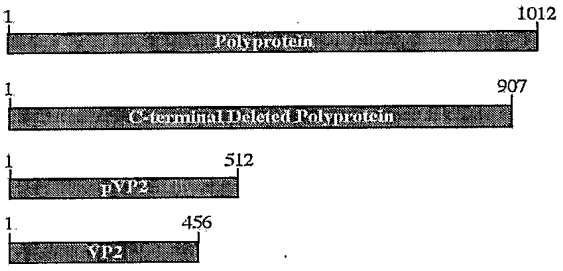
a



b

Gene Construct

Resulting Structure



VLP (T=13) and Type I Tubules*

Type I Tubules†

Twisted Tubules‡

23 nm T = 1 Capsids¶

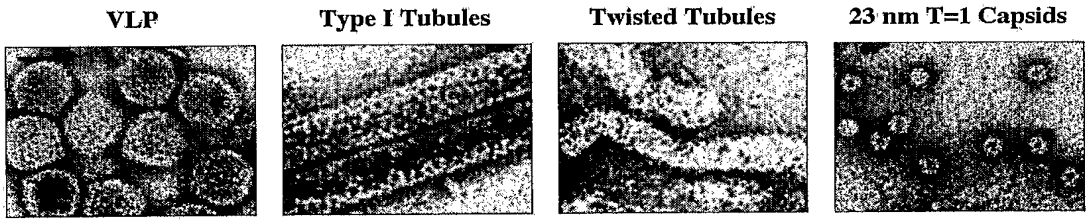


Fig. 1

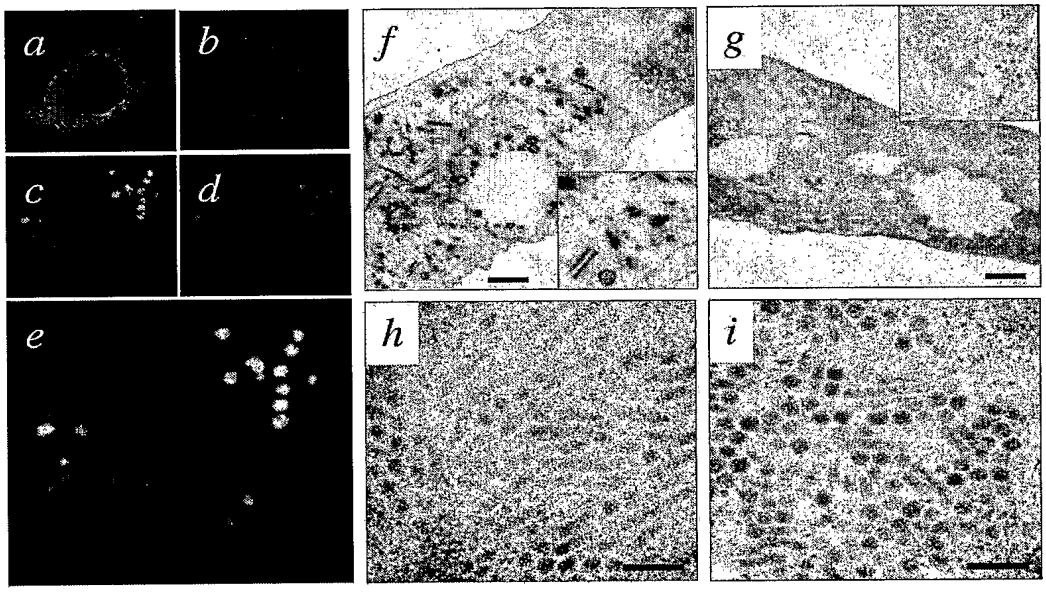


Fig. 2

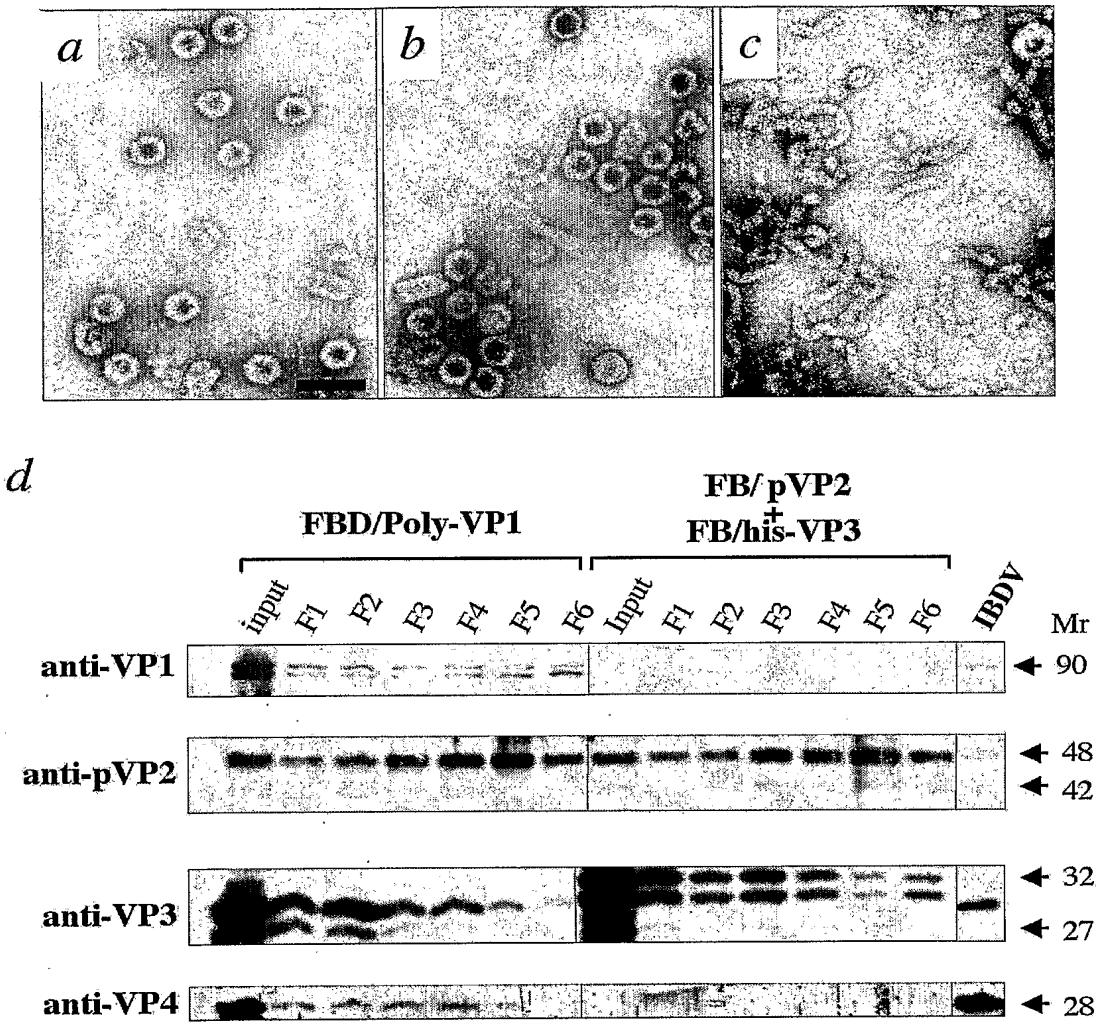

a
b
c
d
FBD/Poly-VP1
FB/pVP2
+
FB/his-VP3
input
F1
F2
F3
F4
F5
F6
Input
F1
F2
F3
F4
F5
F6
IBDV
Mr
anti-VP1
90
anti-pVP2
48
42
anti-VP3
32
27
anti-VP4
28

Fig. 3

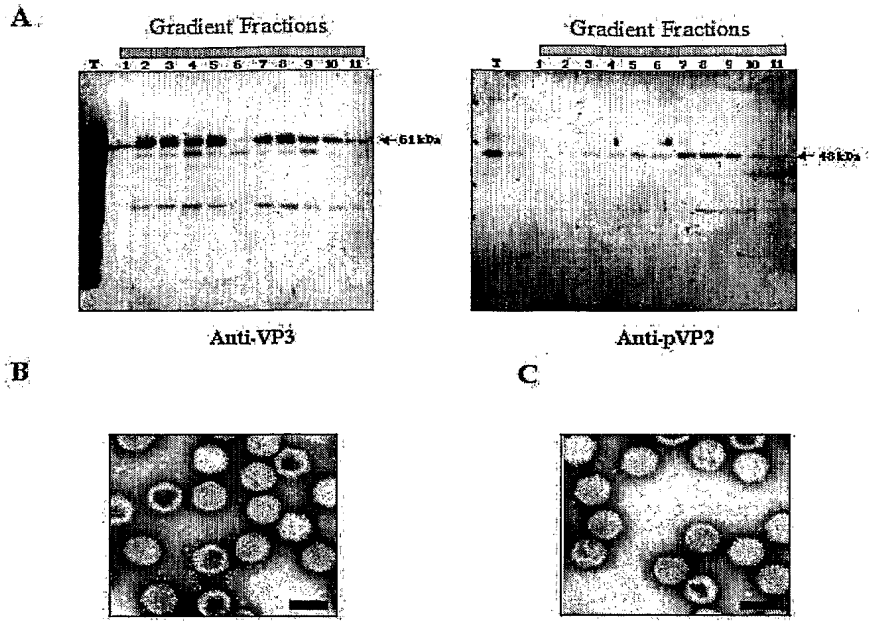

A
Gradient Fractions
T 1 2 3 4 5 6 7 8 9 10 11
61kDa
Anti-VP3
Gradient Fractions
T 1 2 3 4 5 6 7 8 9 10 11
48kDa
Anti-pVP2
B
C

Fig. 4